

Chem 226 / Practice Questions for Exam 1; **Note:** incomplete collection, content & emphasis will vary.

**Exam 1 Fall 2002:** Questions were developed from Worksheets, Practice Questions, Homework & On-line Exercises/Exams. Distribution of points: [GENERAL TOPICS: 7 multiple choice (~20%), 5 short answer (~20%); resonance (~10%); nomenclature (~10%); functionality (~10%); structures/drawing (~15%) ; acids-bases/reactions/balancing (~15%); conformational analysis (~10%)

1) Which molecule would have a dipole moment equal to zero?

a)  $\text{CCl}_4$  b)  $\text{CH}_3\text{OH}$  c)  $\text{CH}_3\text{OCH}_3$  d)  $\text{CH}_3\text{Cl}$  e)  $\text{H}_2\text{O}$

2) How many resonance structures can be written for the  $\text{NO}_3^-$  ion in which the nitrogen atom bears a formal charge of +1?

a) 1 b) 2 c) 3 d) 4 e) 5 f) none

3) Select the most electronegative element.

a) O b) H c) N d) 4 e) C f) Li

4) In which of the following compounds could be found the shortest carbon-carbon bond(s)?

a)  $\text{C}_4\text{H}_8$  b)  $\text{C}_4\text{H}_{10}$  c)  $\text{C}_3\text{H}_4$  d)  $\text{C}_6\text{H}_6$  e)  $\text{CH}_4$

5) The strongest of attractive forces is which type?

a) anion-anion b) hydrogen bonds c) cation-anion d) Van der Waal's  
e) ion-dipole f) Edinburgh forces

6) Which of these bases is the strongest one which can be used (and retains its basic character) in aqueous solution?

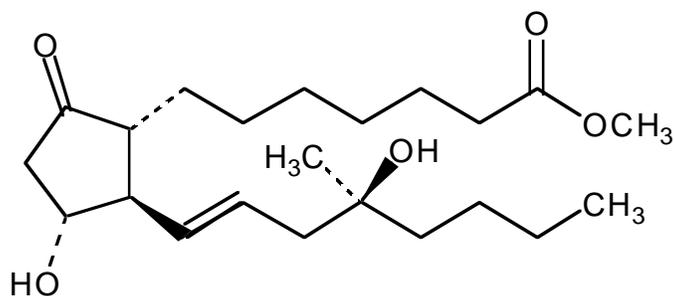
a)  $\text{OH}^-$  b)  $\text{CH}_3\text{O}^-$  c)  $\text{NH}_2^-$  d)  $\text{F}^-$  e)  $\text{NH}_3$

7) Name three types of organic reaction mechanisms: \_\_\_\_\_ ,  
\_\_\_\_\_ and \_\_\_\_\_ .

8) Draw the Lewis (dot) structure for each of the following molecular formulas:

(a)  $\text{C}_2\text{H}_6\text{O}$  (an ether)

(b)  $\text{CH}_3\text{CONH}_2$



(11*R*, 16*S*)-Form

9) Misoprostol is a prostaglandin that has been screened as a possible anti-ulcer therapeutic.

a) Name and identify all of the functions in the molecule by circling them in the structure and placing the appropriate number from below next to them. (Be sure to indicate  $1^\circ$ ,  $2^\circ$  and  $3^\circ$  for the function where appropriate.)

NAME (type of chemical functionality):

- 1)
- 2)
- 3)
- 4)
- 5)

b) Which bond is shorter C-OH or C-CH<sub>3</sub>? Why?

c) Which bond has greater ionic character C-O or H-O ? Why?

d) How many pi bonds (total) are there in the molecule? \_\_\_\_\_

e) Is the C-C double bond *cis* or *trans*? \_\_\_\_\_

f) What is Misoprostol's molecular formula? \_\_\_\_\_

10) Methanol has acid-base ("amphiprotic") properties that are similar to those of water. Write chemical equations with arrows which clearly illustrate methanol functioning as (1) an acid with

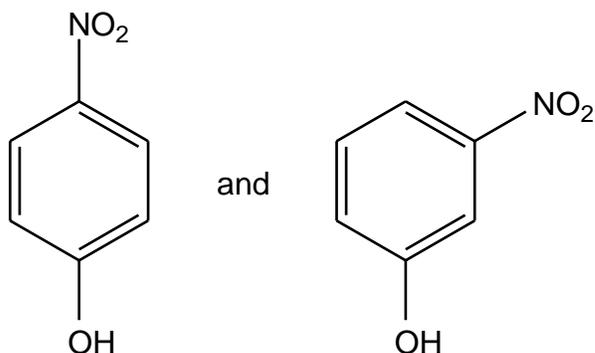
$\text{NH}_2^-$  as a base and (2) as a base with  $\text{H}_2\text{SO}_4$  as an acid.

(1)

(2)

11) Compare the acidity of each pair of compounds shown below, identify the more strongly acidic of the two, and give the reasons for your choice.

(a)



Reason:

b)  $\text{CH}_3\text{CH}_2\text{OH}$  and  $\text{CH}_3\text{CH}_2\text{SH}$

Reason:

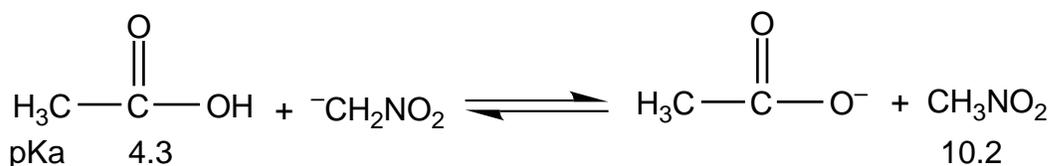
c)  $\text{C}_6\text{H}_5\text{OH}_2^+$  and  $\text{C}_6\text{H}_5\text{NH}_3^+$

Reason:

d)  $\text{CF}_3\text{CO}_2\text{H}$  and  $\text{Cl}_3\text{COOH}$

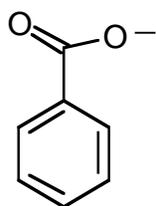
Reason:

12) Using the  $\text{pK}_a$  values given, decide whether the equilibrium will lie toward the right or the left. Give a justification for your choice.

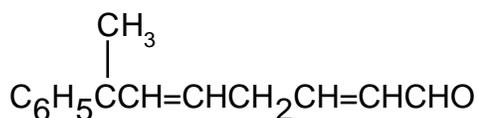


\_\_\_\_\_ Justification:

13) Draw 5 different resonance structures for the following compound (At least one should have 3 formal charges.). Indicate electron movement with arrows for each structure:

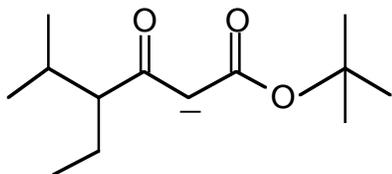


14) Draw the following condensed formula as a bond line formula and draw in any formal charges.



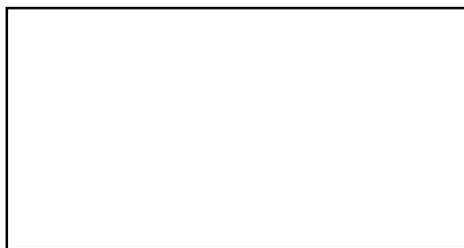
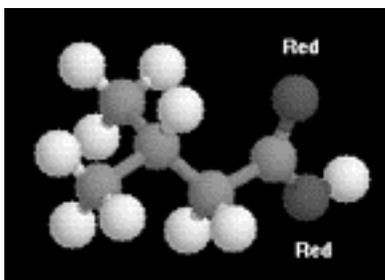
Name the function \_\_\_\_\_

15) Draw the following charged bond line formula as a condensed formula.



Name this type of reactive, charged species \_\_\_\_\_

16) Draw a bond line or condensed structure for the following ball and stick model.



Name the function \_\_\_\_\_

18.) A compound with an odor of garlic was analyzed by combustion. Calculation of the data produced an empirical formula of  $C_3H_5S$ . The molecular formula was determined to be 146 amu. What is the compound's molecular formula.

19) A tertiary aromatic amine has a molecular formula of  $C_8H_{11}N$ . Draw its structure.

20) Draw structural formulas for 2 different geometrical isomers of an alkene with 5 carbon atoms.

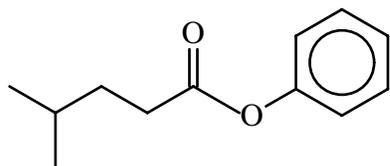
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21) Provide appropriate structures:



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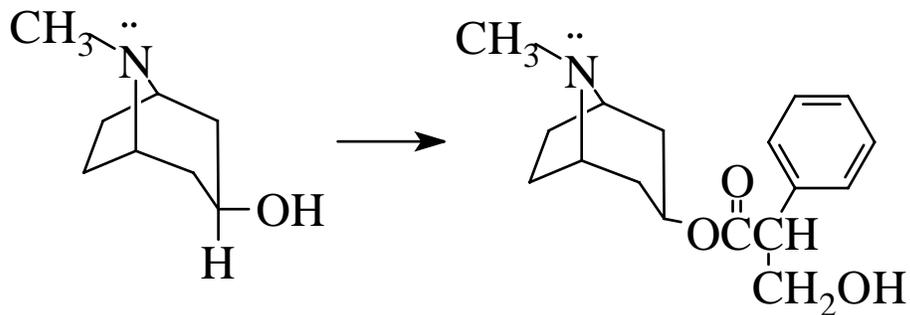
Bond-Line Structural Formula



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Condensed Structural Formula

22) Identify all of the functional groups in compound (I) and Atropine (II) which can be prepared from it.



(I)

(II) Atropine

Functions:

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Functions:

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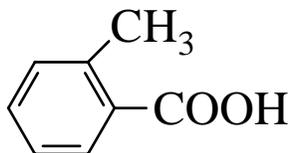


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23) Draw as many resonance structures as you can for the toluate anion which is produced when toluic acid is treated with sodium hydroxide.



Toluic Acid